**COMMONWEALTH OF MASSACHUSETTS**
**Office of Consumer Affairs & Business Regulation**
**DIVISION OF ENERGY RESOURCES**

# RENEWABLE ENERGY PORTFOLIO STANDARD

# ADVISORY RULING
**FOR**
# RENEWABLE OIL INTERNATIONAL® LLC'S PROPOSED BIOOIL PROJECT

**March 9, 2004**

## 1. Advisory Ruling – Request of Renewable Oil International LLC

Renewable Oil International® LLC (ROI) has requested that the Massachusetts Division of Energy Resources (DOER or the Division) provide an Advisory Ruling with regard to the qualification for the Massachusetts Renewable Energy Portfolio Standard (RPS) of a proposed new BioOil Project.[1] This document is DOER's response to ROI's request.

The RPS regulations, at 225 CMR 14.06(5),[2] provide an opportunity for a generation unit owner or developer "to request an advisory ruling from the Division to determine whether a Generation Unit would qualify as a New Renewable Generation Unit."[3]

## 2. Description of ROI's Biomass Project

ROI proposes to design, fabricate, install, and operate a "fast pyrolysis" unit at a sawmill in western Massachusetts. That unit will extract BioOil from a feedstock of sawmill debris. The BioOil will be transported to the facilities of Advanced Engine Technologies (AET) for testing with engines in its laboratories. Based on those tests, "ROI will determine what modifications will be necessary to convert engines to operate on straight BioOil fuels. A [60-hp rotary] engine/generator modified for operation on straight BioOil fuels will then be installed at the project site [in Massachusetts] and tested."[4]

This Advisory Ruling will address the proposed plant's fuel stream, its technology, and its air emissions.

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[1] The ROI request was provided in the form of a letter to Howard B. Bernstein at DOER, dated December 3, 2003, with a five page project description, dated December 5, 2003, attached. The letter and its attachment will be referenced hereafter as the 12/3/03 letter. The project is being undertaken with financial assistance from the Massachusetts Technology Collaborative.

[2] Hereafter, all references to the RPS regulations will be to sections of 225 CMR 14.00.

[3] More information about Advisory Rulings for MA RPS is at http://www.state.ma.us/doer/rps/advisory.htm.

[4] ROI 12/3/03 letter.

### 3. Discussion of Eligible Biomass Fuels

ROI states in its 12/05/03 description that "The fuel supply for the project will be forestry mill waste and forestry harvesting waste." Such a fuel supply clearly would fall within the definition of "Eligible Biomass Fuel" at Section 14.02.

### 4. Discussion of Advanced Biomass Technology

The RPS regulations provide, at Section 14.05(1)(a)6, that the qualification of biomass generation units is limited to "low emission, advanced biomass power conversion technologies using an Eligible Biomass Fuel." These criteria are designed to insure that the RPS provides incentives for older, dirtier technologies to be replaced by cleaner and more efficient technologies. DOER also believes that biomass technologies should improve over time, both pursuant to the incentives created by the RPS and, more broadly, continued technological progress in the electricity generation sector.

As summarized in its 12/5/03 description, ROI defines fast pyrolysis as "a high temperature, thermochemical process in which biomass is rapidly heated in the absence of oxygen. As a result pyrolysis decomposes to generate mostly vapors and aerosols and some charcoal." ROI summarizes the essential features of fast pyrolysis as follows:

- Very high heating and heat transfer rates, which usually requires a finely ground biomass feed.
- Carefully controlled pyrolysis reaction temperature of around $500^0$C in the vapor phase, with short vapor residence times of typically les [sic] than 2 seconds.
- Rapid cooling of the pyrolysis vapors to give the BioOil product.[5]

The technology for refining BioOil from biomass feedstock by fast pyrolysis is a fairly new one, which is still undergoing developmental engineering and testing of prototypes. Although Ensyn Group Inc. has a small number of commercial installations in operation utilizing its Rapid Thermal Processing (RTP™) technology,[6] most types of fast pyrolysis are still largely in developmental stages and not commercialized.

This is a technology that holds much promise, with potential for "bio-refineries" to produce, from various biomass feedstocks, bio-oils and other bio-chemicals that may come to replace some fuels and petrochemicals produced from fossil petroleum. ROI's project would represent a scaling-up – from laboratory bench scale to small commercial scale – of a form of fast pyrolysis for which a patent is pending and for which information is proprietary. Within those constraints, it is described by ROI as operating at lower temperatures and employing more efficient heat carriers than its competitors, with the result that it should cost less both to fabricate and to operate.[7]

DOER finds that the technology of ROI's fast pyrolysis process is an advanced biomass power conversion technology, in concurrence with the decision by the Massachusetts Technology

[5] ROI 12/5/03 description.

[6] See http://www.ensyn.com/what/renewable.htm for an account of Ensyn Group's biomass activities.

[7] ROI 12/5/03 description.

Collaborative (MTC) to fund the project under its Emerging Technology Demonstration Solicitation.[8]

The engine/generator that eventually will be fueled with BioOil and produce electricity is expected to be a rotary engine specially modified to operate with 100% BioOil, following bench tests on several engines at Advanced Engine Technologies. Thus, the equipment will not be simply "off the shelf" and also will be regarded by DOER as "advanced" for the purposes of RPS qualification. However, it is the advanced nature of the fast pyrolysis technology that is central to DOER's technology evaluation in this Advisory Ruling.

## 5. Discussion of Low Emissions

A generation unit using an eligible biomass fuel and advanced technology must meet the criterion of "low emissions" in order to be an eligible New Renewable Generation Unit for the RPS, per the regulations at 14.05(1)(a)6. This criterion does not set specific emission targets. Rather, the threshold for eligibility is expected to become more stringent as biomass energy conversion and emission control technologies improve. In addition, that threshold might differ among fuels, technologies, and project scale – as determined by the MA DEP. Under the RPS regulations at 14.05(1)(a)6.a, a generator must receive a valid air permit from its appropriate state air quality regulatory agency to qualify as an eligible biomass generator.[9] In addition, that same subsection provides that the project "must . . . demonstrate to the satisfaction of the Division that its emission rates are consistent with emission rates for comparable biomass units as prescribed by the Massachusetts Department of Environmental Protection."

ROI identifies three sources of emissions for the project:

> (1) the BioOil production process itself, (2) the engine/generator that will operate off the syngas produced by the BioOil plant, and (3) the engine/generator that will operate with straight BioOil fuels.[10]

ROI expects the BioOil production process, as designed, to emit at very low levels, which would have to meet MA DEP standards in any case. The syngas-fueled engine/generator that maintains the pyrolysis process has similar expectations and also would have to meet MA DEP standards. However, emissions from the engine/generator that eventually is installed in Massachusetts and will run on BioOil are an unknown at this time, since the relevant testing will be part of the project itself.

DOER's conclusion from the information available in the 12/5/05 description is that the project is likely to be qualified as using "low emission" technology. However, such qualification would be contingent on receiving more detailed information in a Statement of Qualification Application (SQA), which would be evaluated by the MA DEP. The BioOil refining unit itself would not be appropriate for a SQA. It seems logical to DOER at this time that the SQA would be submitted when ROI has already completed the engine testing and has selected its equipment for installation and electricity generation in Massachusetts. The scope of the SQA should include

[8] Further information is at the MTC press release – http://www.masstech.org/NewsandReports/press/pr_10_1_03_energy.htm.

[9] If the air quality regulations applicable in the jurisdiction where the Generation Unit is located do not require an air permit, then the unit must satisfy the requirements of the RPS regulations at 14.05(1)(a)6.c.

[10] ROI 12/5/03 description.

the emissions only of the fast pyrolysis unit and the engine/generator, but not the emissions of prototypes or other devices used for testing. The fact that the relevant installation all would be located in Massachusetts simplifies DOER's evaluation. Not only would this project possess a Valid Air Permit before it begins its operation, but the emission rates in that permit would be those prescribed by the MA DEP and, thereby, qualify as "low."

## 6. Summary of Ruling

DOER has found the BioOil project proposed by Renewable Oil International® LLC to fall within the eligibility criteria for new renewable generation biomass units as described in the RPS regulations at 14.05(1)(a)6. The following summarizes this finding, and it also notes several key issues and requirements for ROI to consider in its project planning, and by which DOER would be guided in reviewing its application for the generation unit to qualify as a New Renewable Generation Unit for the Massachusetts RPS.

1. DOER finds the proposed fuels – forestry mill waste and forestry harvesting waste – to be consistent with the definition of Eligible Biomass Fuels in the RPS regulations.
2. DOER finds that the patent-pending fast pyrolysis technology proposed for use in the project, as well as the internal combustion engine, specially modified to operate on 100% BioOil, will qualify as advanced biomass power conversion technologies.
3. DOER finds that, if the proposed equipment receives Valid Air Permit(s) from the Massachusetts DEP, the project would thereby qualify as using low emission technology. If the units fall below the threshold for DEP permitting requirements, then the DEP will evaluate their expected emissions for DOER. However, DOER would consider the "demonstration" nature of the project in reaching its determination. In any case, ROI has stated its intention to take all appropriate measures to achieve low emissions from the units.
4. ROI should be cognizant of all state and federal standards that potentially could be applicable to the project and, of course, work cooperatively and openly with the MA DEP and with its host community during its project design, construction, and operation.
5. ROI should note that, while DOER may grant a Statement of Qualification for the project, it would always be contingent on ROI's obtaining DEP permit(s), if required, and on its operating the plant in compliance with both (a) any DEP permits and regulations and (b) DOER's RPS regulations. ROI should note as well that, once DOER grants a Statement of Qualification, further advances in biomass power conversion technologies will have no effect on the plant's MA RPS qualification.